Ordering number: EN 2651A

Monolithic Linear IC

SANYO No. 2651A

LA3246

STEREO PREAMP FOR COMPACT DOUBLE CASSETTE PLAYBACK-ONLY USE

The LA3246 is a stereo preamp IC for double cassette tape playback-only use. The LA3246 is intended for use in portable radio-cassette tape recorders and tape decks.

Applications

- Stereo compact cassette player for playback-only use
- Stereo cassette deck player

Functions

- Preamp x 2, mixing amp x 1, electronic switch x 6

Features

- On-chip electronic switch for input select (auto reverse or A deck/B deck select)
- On-chip electronic switch for normal/higher dubbing select and electronic switch for metal/normal tape select
- Wide operating voltage range (V_{CC} op=3.5 to 14V)
- With output MIX pin (for music select control)
- Low noise voltage (V_{NI}=0.9uV typ, Rg=2.2kohms NAB)
- Can be used in conjunction with the LA3240, 3241, 3242 to make up a double-cassette dubbing system.

Maximum Ratings at Ta=25°C

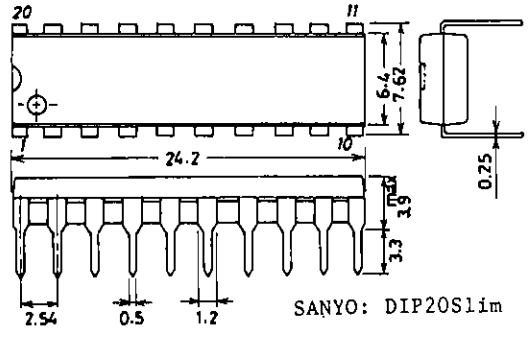
			unit
Maximum Supply Voltage	V_{CC} max	16	V
Allowable Power Dissipation	Pd max	500	mW
Operating Temperature	Topr	-20 to +75	°C
Storage Temperature	Tstg	-40 to +125	°C

Operating Conditions at Ta=25°C

			unit
Recommended Supply Voltage	V_{CC}	6	V
Operating Voltage Range	V_{CC} op	3.5 to 14	V

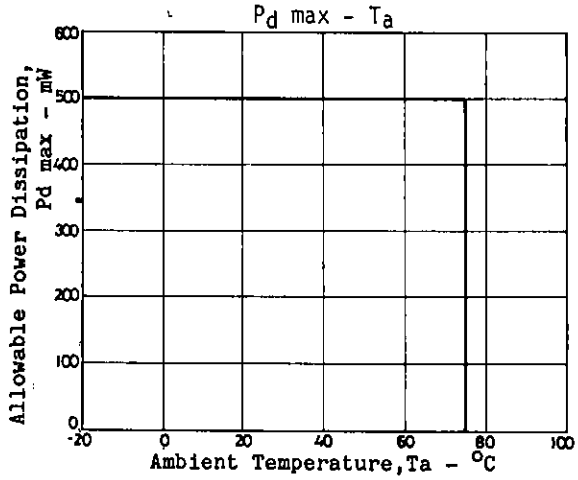
Package Dimensions 3021B

(unit: mm)

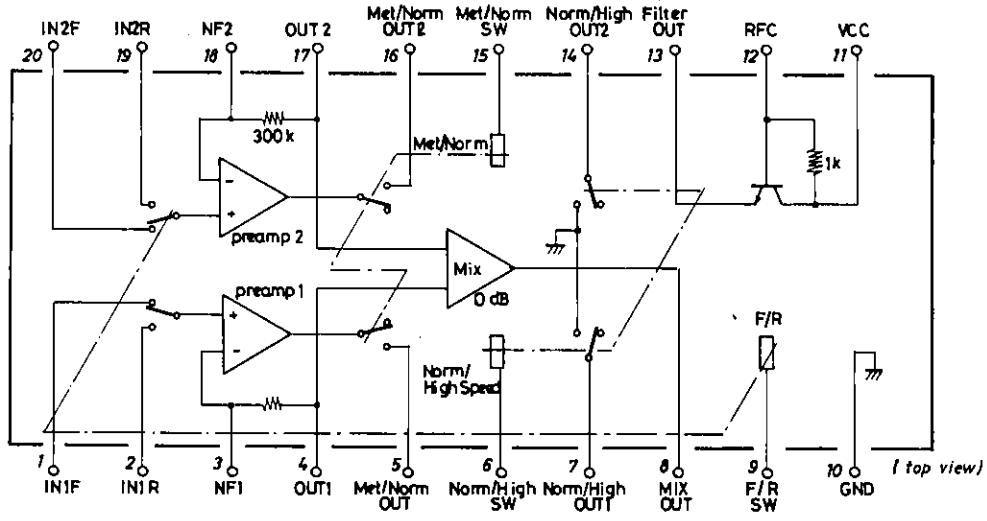


Operating Characteristics at Ta=25°C, V_{CC}=6.0V, R_L=10kohms, f=1kHz, 0dB=0.775V

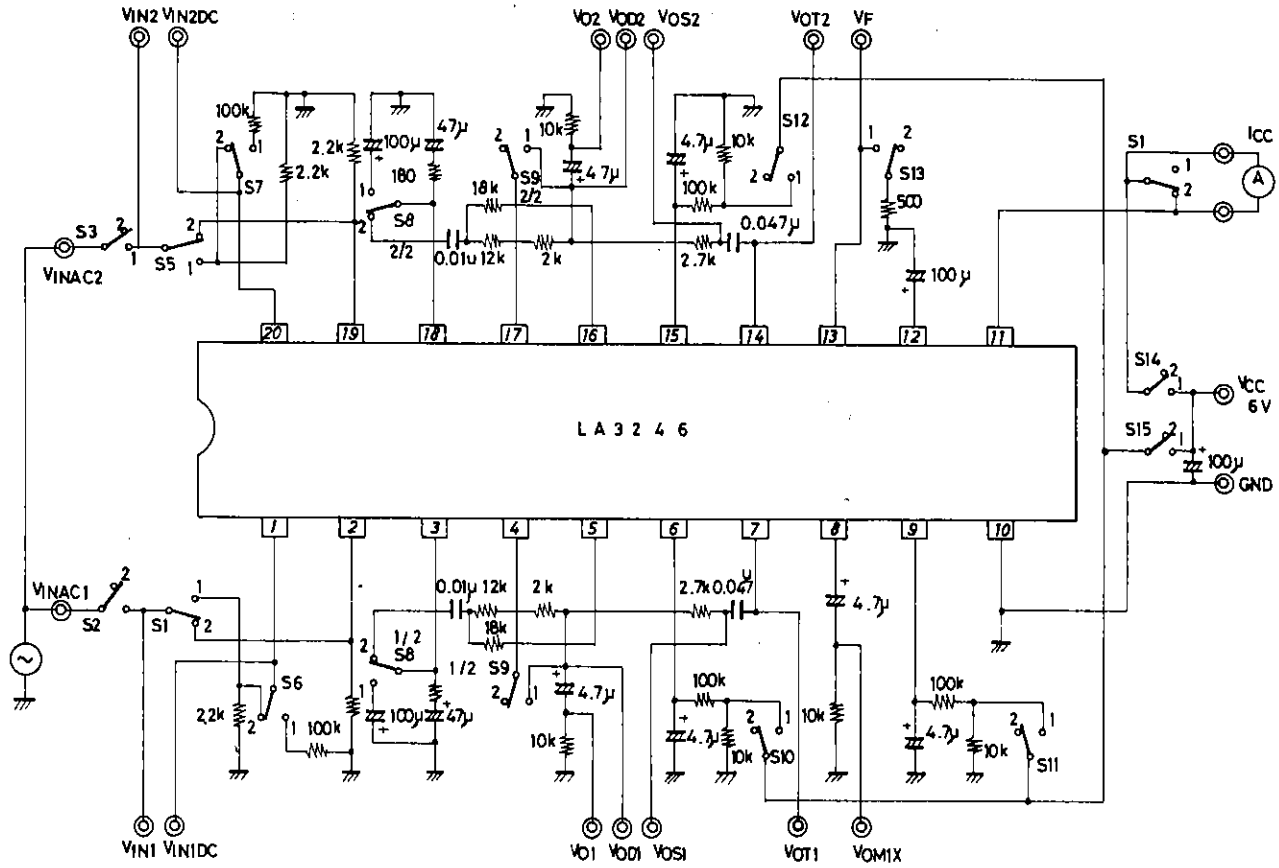
			min	typ	max	unit
Quiescent Current	Icco	Nor/Nor Speed Forward	5	7	12	mA
	Iccs	Metal/High Speed Forward	7	10	17	mA
Voltage Gain (Open)	VGo		75	85		dB
(Closed)	VG	Nor/Nor Speed, NAB	39.5	40.5	41.5	dB
Total Harmonic Distortion	THD	Vo=0.65V, Nor/Nor Speed		0.03	0.2	%
Maximum Output Voltage	Vo max	THD=1%, Nor/Nor Speed	0.7	1.2		V
Crosstalk (between Channels)	CT1	Vo=-5dBm, Rg=2.2kohms, Nor/Nor Speed	50	65		dB
Crosstalk (between F/R)	CT2	Vo=-5dBm, Rg=2.2kohms, Nor/Nor Speed	50	65		dB
Channel Balance	V_{BL}	Vi=-50dBm		0	2	dB
Equivalent Input Noise Voltage	V_{NI}	Rg=2.2kohms, B.P.F 20Hz to 20kHz, Nor/Nor Speed		0.9	1.7	uV
MIX Output Voltage	VoMIX	Vo1, Vo2=0dBm	-3	0	3	dB
Ripple Filter Output Current	I_{FOUT}			10	15	mA
Electronic Switch ON-State Resistance	Ron	Between P1 to P4 and 5, between pin 16 and 17		100	250	ohm
		Between P1 to P7 and 10, between pin 10 and 14		30	70	ohm
DC Feedback Resistance	R_F		240	300	360	kohm
Input Bias Current	I_F			0.5	3.0	uA



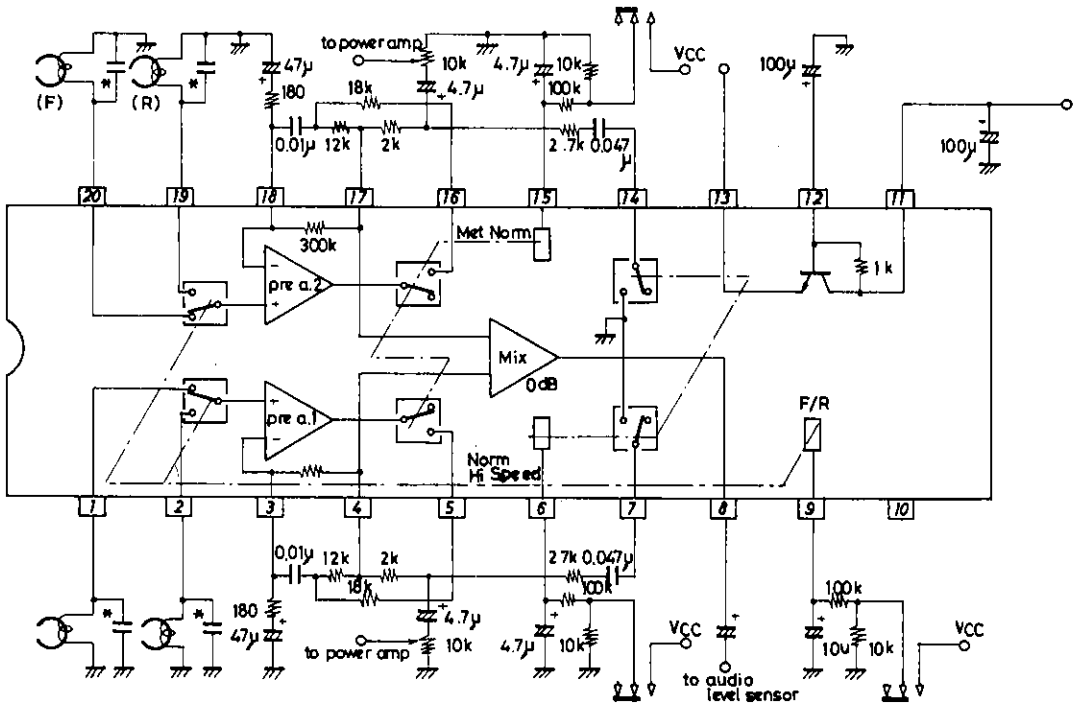
Equivalent Circuit Block Diagram



Test Circuit



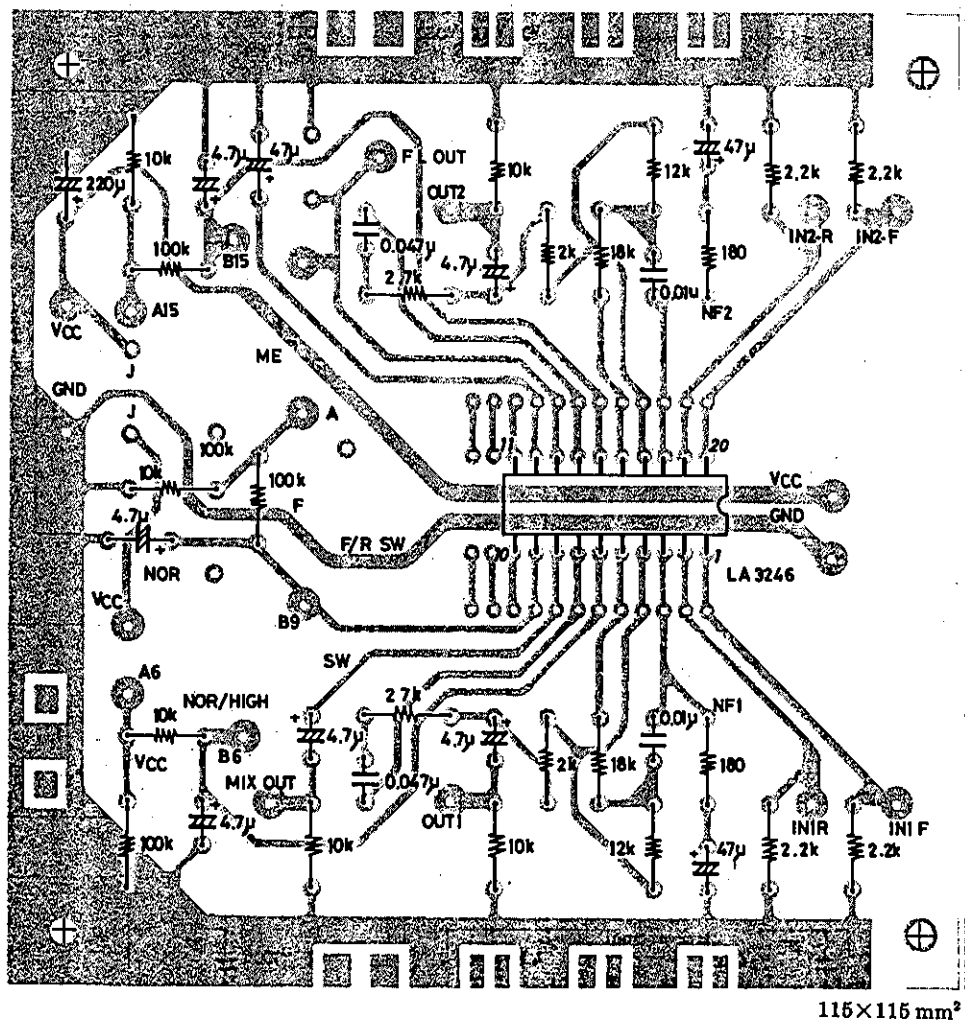
Sample Application Circuit



Unit (resistance: Ω, capacitance: F)

Note 1. The output frequency characteristic for Nor Tape/High Speed Mode (pin 6: High, pin 15: Low) and that for Metal Tape/Nor Speed Mode (pin 6: Low, pin 15: Low) are set to be the same.
2. Since the input bias current flows out of pins 1,2 and pins 19,20, a resistor (recommended value: 30kohms to 350kohms, maximum value: 500kohms) must be connected across pins 1,2 and GND and across pins 19,20 and GND when connecting a coupling capacitor in series with these pins.
3. *: A capacitor must be connected to the input to absorb a surge.
4. The electronic select switching level is approximately 1/2 x (V_{CC}-0.9).
5. The value of the capacitor connected to pin 12 can be increased/decreased to adjust starting time t_s at the time of application of V_{CC}. (C=100uF, t_s=0.4sec.) If the capacitor value is made less than 47uF, the ripple rejection will get worse.
6. No capacitor is connected to pin 13. (Even if connected, the ripple can not be rejected.)
7. Extreme caution should be exercised when handling the IC as it is subject to dielectric breakdown.

Sample Printed Circuit Pattern (Cu-foiled area)



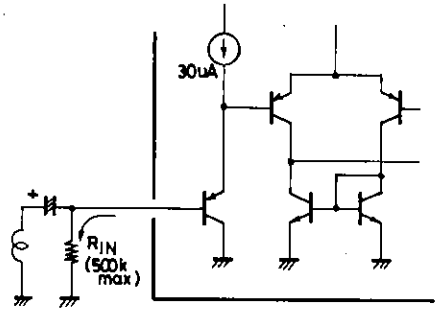
115×115 mm²

Unit (resistance: Ω, capacitance: F)

Proper cares in using the IC

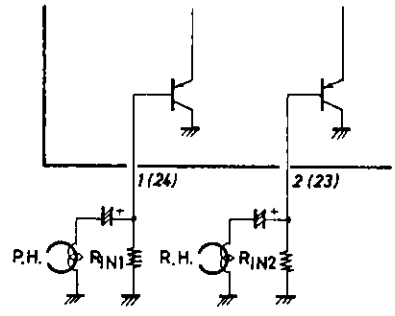
(1) It is recommended to connect a surge absorbing capacitor across input pins 1,2 and GND and across input pins 19,20 and GND.

(2) The base of a PNP transistor is connected to input pins 1,2 and 19,20. If an electrolytic capacitor is connected in series with the input pins, connect input resistor R_{IN} across input pin and GND. The value of R_{IN} must not exceed 500kohms. (Reason: To minimize the variation in output DC voltage at the time of input switching)



If a resistor of more than 500kohms is connected across input pin and GND, the noise (output) caused by amp 1 - amp 2 select is liable to increase at the time of F/R switching.

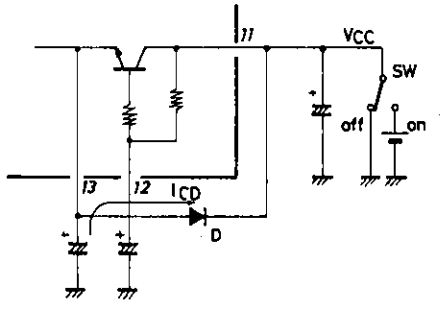
(3) When an electrolytic capacitor is connected to input pins 1,2 (or 23,24), make the value of R_{IN1} as equal to that of R_{IN2} as possible.



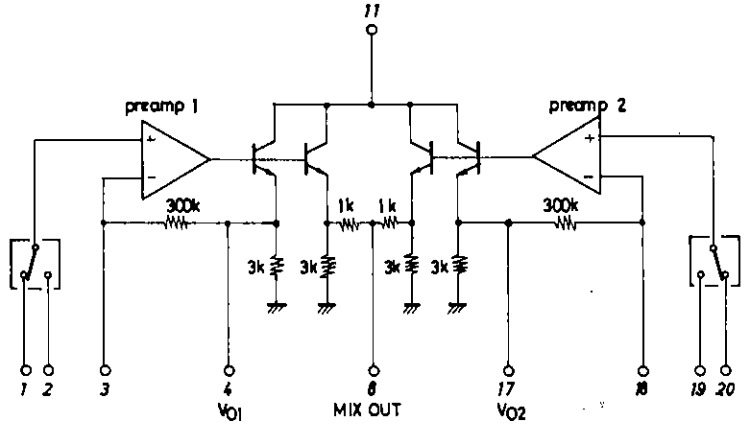
The difference in the value between R_{IN1} and R_{IN2} causes the variation in amp output DC voltage at the time of F/R switching. Therefore, the input DC voltage (voltage across R_{IN}) must be made as equal as possible.

(4) The amp output characteristics are designed to be the same in the Nor Tape /High Speed (pin 15 GND/pin 6 V_{CC}) and Me Tape/Nor Speed (pin 15 V_{CC}/pin 6 GND) modes. (Refer to Sample Application Circuit, external constants.)

(5) When externally turning ON/OFF power supply pin 11 (by bringing pin 11 to $+V_{CC}$/GND level) with a capacitor connected to pin 13, connect external diode D, as shown below, so that no breakdown (or deterioration) of the IC system is caused by I_{CD} when the switch is turned OFF. When no capacitor is connected to pin 13, diode D is not required.



(6) The output MIX circuit is of the emitter follower configuration as shown below.



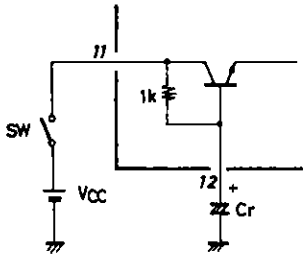
Unit (resistance: Ω)

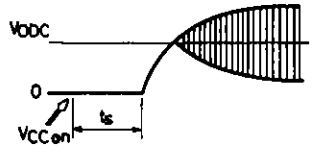
The MIX OUT output level Vo MIX at the time a signal is applied to PRE1 (or PRE2) only is 1/2 as compared with output levels Vo1, Vo2 at the time the same input signal is applied to both channels.

$$Vo\ MIX = \frac{1}{2} Vo1 \left(= \frac{1}{2} Vo2\right)$$

where Vo1=Vo2

(7) Output waveform starting time





Example of rise waveform at pin 4 (or 17)

When supply voltage V_{CC} is switched ON, the amplifier output (pins 4,17) will rise. Output waveform ON time t_s can be varied by capacitor Cr connected to pin 12.

Refer to Data Cr - t_s.

The minimum value of Cr is 47uF.

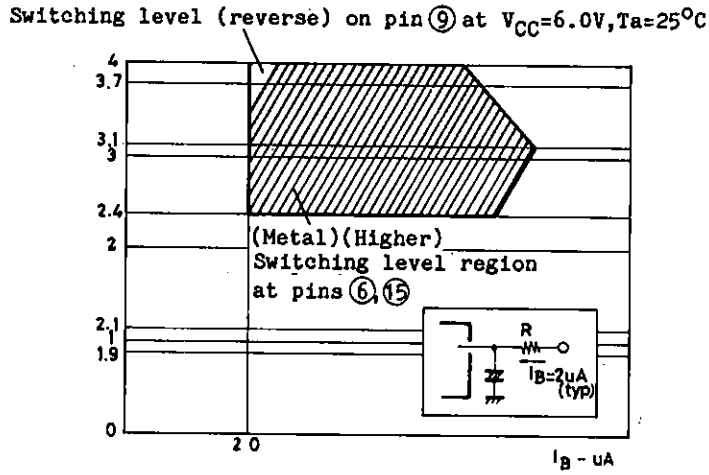
(8) Electronic select switching level

. The switch level at V_{CC}=6.0V is shown below.

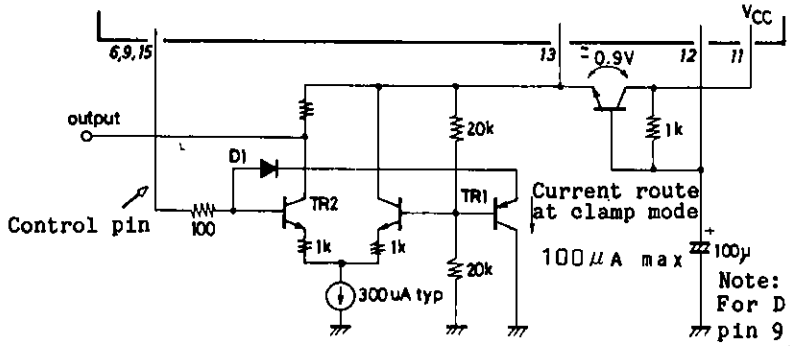
Pin	Switch Mode	Switching Level		Clamp Voltage	Control Current typ (flow-in) (at operation finish)	Mode	
		Operation Start	Operation Finish			(+)	(-)
6	Normal/Metal	2.1V	2.4V	3.7V	2uA	Metal	Normal
9	Forward/Reverse	2.1V	3.1V	3.4V	2uA	Reverse	Forward
15	Normal/Higher	2.1V	2.4V	3.7V	2uA	Higher	Normal

As shown above, there is a difference in the switching level at three control pins (6,9,15) between operation start and operation finish.

. Switching level and mode at each pin (experimental value)



. Control circuit
The control circuit for each CONT pin is configured as shown below. When a voltage more than a given value is applied, the level on the pin is fixed by clamp diode D1.



Description

. Switching level V_{SW} of the control circuit is fixed by voltage V_{13} which is 1/2 of the voltage on pin 13.

$$V_{SW} = \frac{1}{2} V_{13}$$

. Clamp voltage V_{CLP} at the time a voltage is applied to the CONT pin

$$V_{CLP} = \frac{1}{2} \times V_{13} + V_{D1} + V_{BE1}$$

$$= \frac{1}{2} \times V_{13} + 0.6(0.3) + 0.6$$

$$= \frac{1}{2} \times V_{13} + (0.9 \text{ or } 1.2)$$

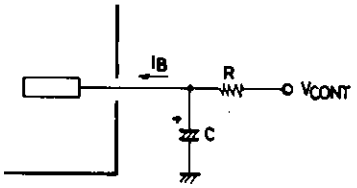
where 0.9V is for pin 9.
1.2V is for pins 6,15.

. The maximum voltage at which the CONT pin is brought to GND level is fixed by the level at which the Q2 is completely turned OFF.
This level is:

$$\frac{1}{2} \times V_{13} - V_{BE2} = \frac{1}{2} \times V_{13} - 0.6 \text{ [V]}$$

Switching is performed at a level less than this.

. To turn ON/OFF
When turning ON:



To turn ON the control circuit to finish the operation, I_B is required. Control voltage V_{OUT} is obtained with I_B of 4uA min.

. V_{CONT} min = R x I_B max + Operation finish voltage
I_B = 4uA
Operation finish voltage
Pins ⑥,⑮ : =1/2 x V_{13}
Pin ⑨ : =1/2 x V_{13} + V_{BE}
=1/2 x V_{13} + 0.6 [V]

. V_{CONT} max = R x I_B max + Clamp voltage
R is restricted by I_B max.
When the supply voltage is fixed, clamp voltage V_{CLP} is fixed. When resistor R is fixed based on a balance with capacitor C, resistor R is restricted by V_{CONT} max. as shown below.

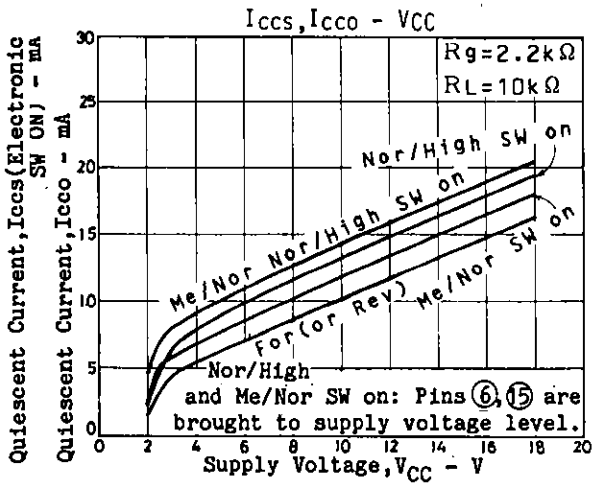
$$I_B \text{ max} = 100\text{uA} \geqq \frac{V_{CONT\ max} - V_{CLP}}{R}$$

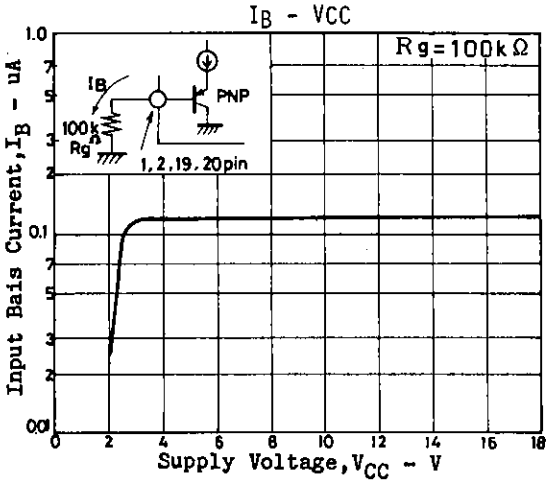
The minimum value of resistor R is fixed by this equation.
Example
Assuming V_{CC}=10V, $V_{CONT\ max}$=10V, Rmin is 50kohms.
Therefore, R=100kohms presents no problem.
When turning OFF:
Bring the level on the CONT pin to a level less than:

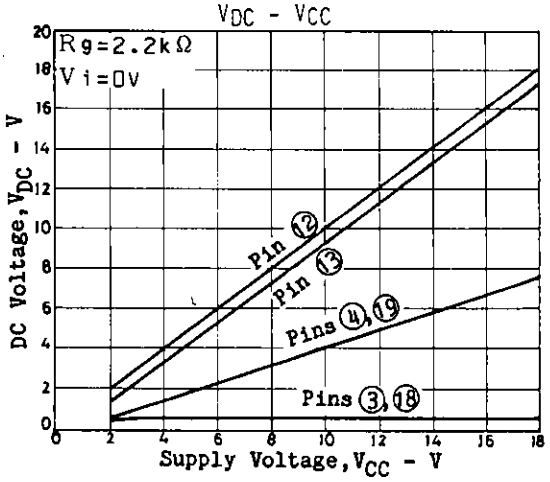
$$\frac{1}{2} \times V_{13} - V_{BE2} = \frac{1}{2} \times V_{13} - 0.6\ [V]$$

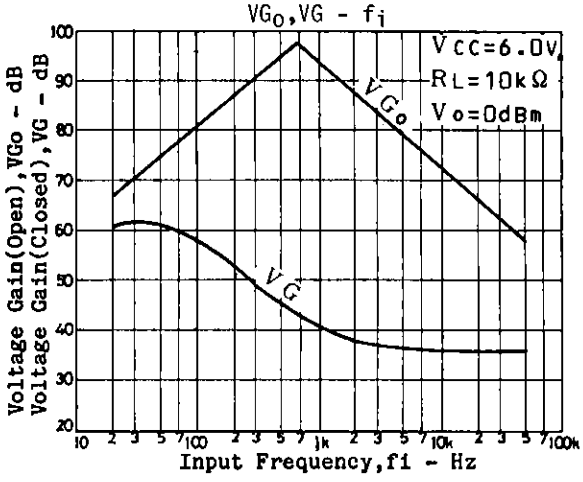
(9) Example of voltage on each pin

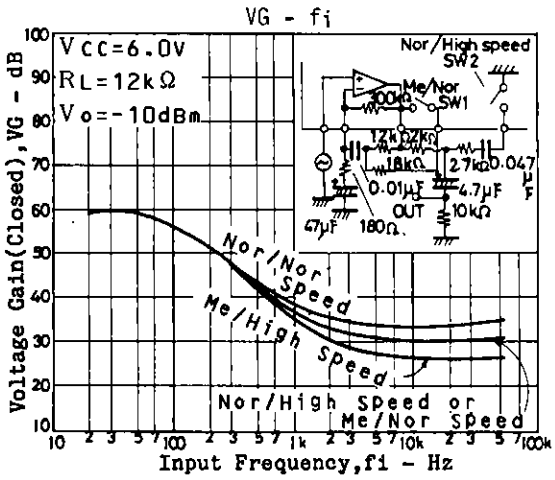
Rg=2.2kohms, Ta=25°C, Vi=0, pins ⑥⑨⑮ GND					
Pin	Supply Voltage, V_{CC} - V				unit
	4.5V	6.0V	9.0V	12.0V	
1	0.3	0.3	0.3	0.3	mV
2	0.3	0.3	0.3	0.3	mV
3	0.59	0.58	0.57	0.56	V
4	1.63	2.23	3.65	5.02	V
5	1.63	2.23	3.65	5.02	V
6	(GND)0	(GND)0	(GND)0	(GND)0	V
7	0	0	0	0	V
8	1.63	2.29	3.64	5.01	V
9	(GND)0	(GND)0	(GND)0	(GND)0	V
10	(GND)0	(GND)0	(GND)0	(GND)0	V
11	Vcc	Vcc	Vcc	Vcc	V
12	4.48	5.96	8.97	11.23	V
13	3.72	5.20	8.21	11.98	V
14	0	0	0	0	V
15	(GND)0	(GND)0	(GND)0	(GND)0	V
16	1.63	2.23	3.65	5.02	V
17	1.63	2.23	3.65	5.02	V
18	0.59	0.58	0.57	0.56	V
19	0.3	0.3	0.3	0.3	mV
20	0.3	0.3	0.3	0.3	mV

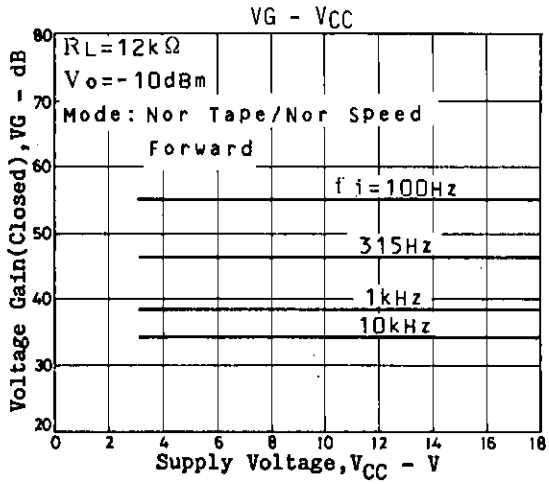

Iccs, Icco - VCC
Rg=2.2kΩ
RL=10kΩ
Nor/High SW on
Me/Nor Nor/High SW on
For(or Rev) Me/Nor SW on
Nor/High and Me/Nor SW on: Pins ⑥, ⑮ are brought to supply voltage level.
Quiescent Current, Iccs(Electronic SW ON) - mA
Quiescent Current, Icco - mA
Supply Voltage, VCC - V

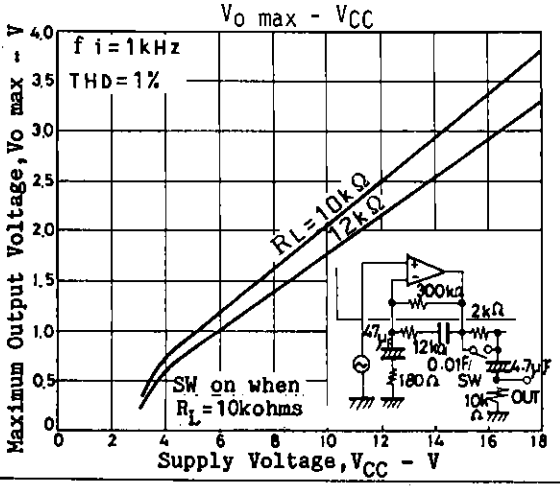

IB - VCC
Rg=100kΩ
IB
PNP
100k Rg
1,2,19,20pin
Input Bais Current, IB - uA
Supply Voltage, VCC - V

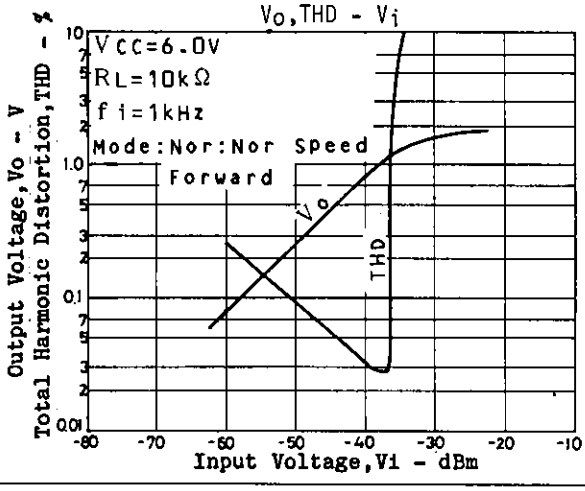

VDC - VCC
Rg=2.2kΩ
Vi=0V
Pin ⑫
Pin ⑬
Pins ④, ⑲
Pins ③, ⑱
DC Voltage, VDC - V
Supply Voltage, VCC - V

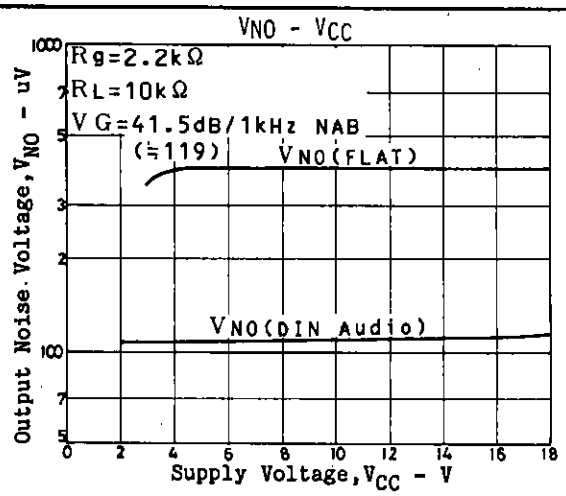

VGo, VG - fi
VCC=6.0V
RL=10kΩ
Vo=0dBm
VGo
VG
Voltage Gain(Open), VGo - dB
Voltage Gain(Closed), VG - dB
Input Frequency, fi - Hz

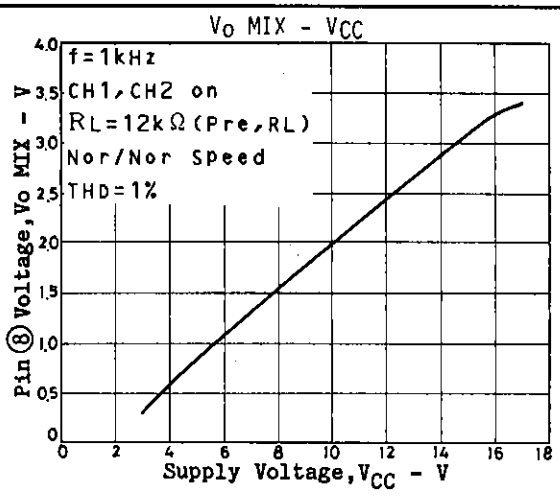

VG - fi
VCC=6.0V
RL=12kΩ
Vo=-10dBm
Nor/High speed SW2
Me/Nor SW1
Nor/Nor Speed
Me/High Speed
Nor/High Speed or Me/Nor Speed
Voltage Gain(Closed), VG - dB
Input Frequency, fi - Hz

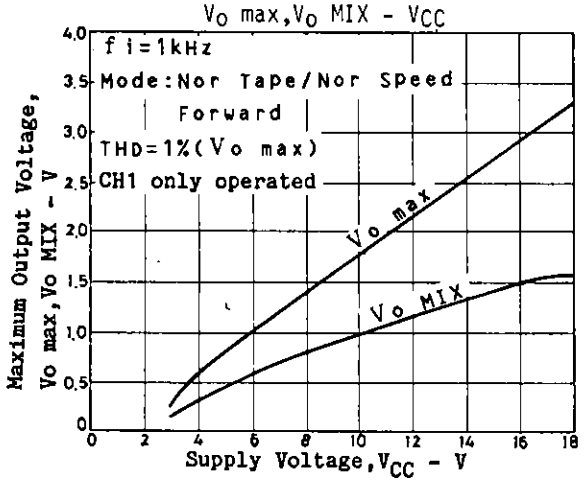

VG - VCC
RL=12kΩ
Vo=-10dBm
Mode: Nor Tape/Nor Speed
Forward
fi=100Hz
315Hz
1kHz
10kHz
Voltage Gain(Closed), VG - dB
Supply Voltage, VCC - V

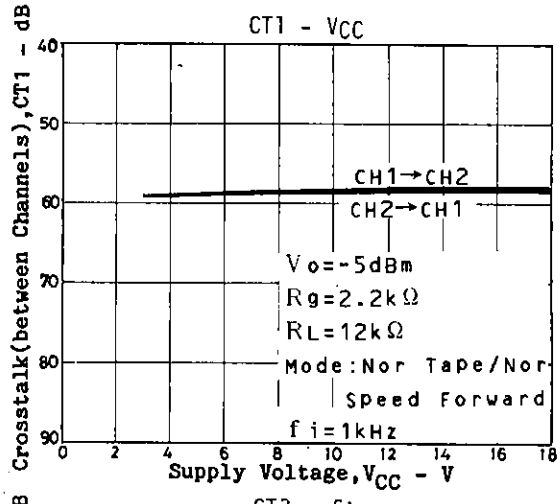

Vo max - VCC
fi=1kHz
THD=1%
RL=10kΩ
12kΩ
SW on when RL=10kohms
Maximum Output Voltage, Vo max - V
Supply Voltage, VCC - V

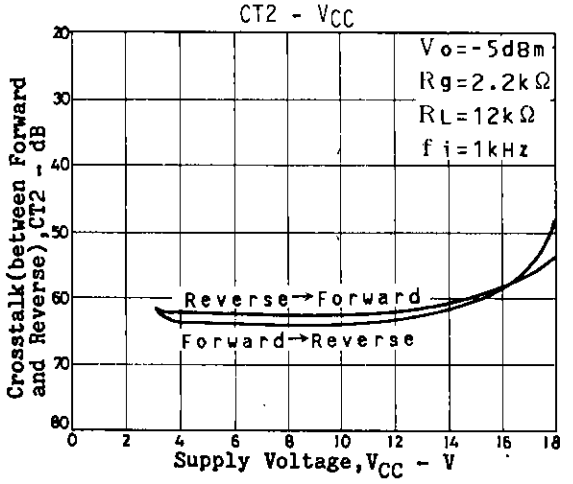

Vo, THD - Vi
VCC=6.0V
RL=10kΩ
fi=1kHz
Mode: Nor: Nor Speed
Forward
Vo
THD
Output Voltage, Vo - V
Total Harmonic Distortion, THD - %
Input Voltage, Vi - dBm

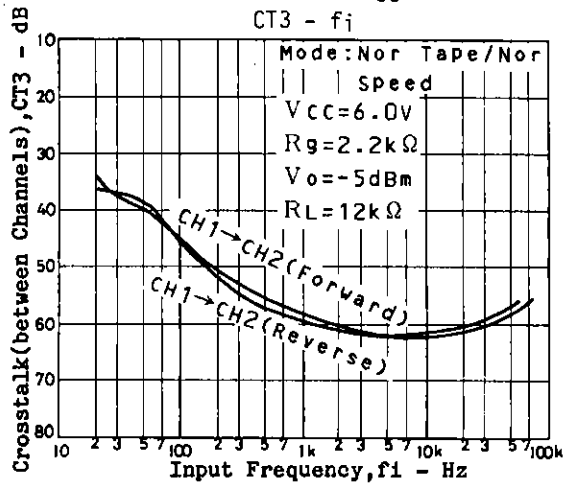

VNO - VCC
Rg=2.2kΩ
RL=10kΩ
VG=41.5dB/1kHz NAB
(≒119)
VNO(FLAT)
VNO(DIN Audio)
Output Noise Voltage, VNO - uV
Supply Voltage, VCC - V

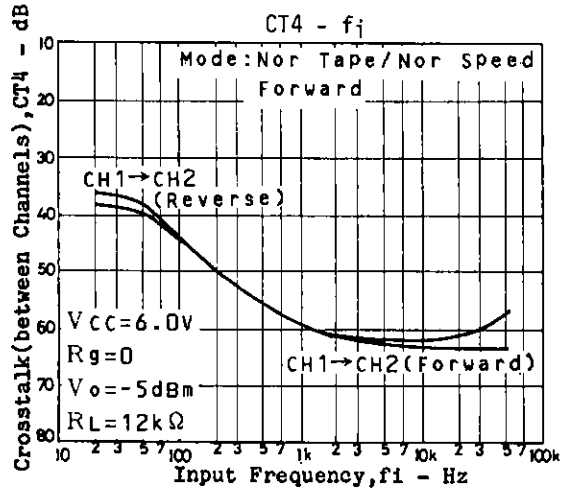

Vo MIX - VCC
f=1kHz
CH1, CH2 on
RL=12kΩ (Pre, RL)
Nor/Nor Speed
THD=1%
Pin ⑧ Voltage, Vo MIX - V
Supply Voltage, VCC - V

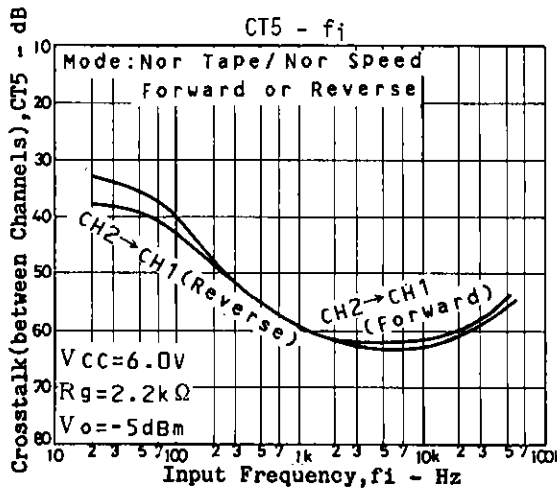

Vo max, Vo MIX - VCC
fi=1kHz
Mode: Nor Tape/Nor Speed
Forward
THD=1% (Vo max)
CH1 only operated
Vo max
Vo MIX
Maximum Output Voltage, Vo max, Vo MIX - V
Supply Voltage, VCC - V


CT1 - VCC
CH1→CH2
CH2→CH1
Vo=-5dBm
Rg=2.2kΩ
RL=12kΩ
Mode: Nor Tape/Nor Speed Forward
fi=1kHz
Crosstalk (between Channels), CT1 - dB
Supply Voltage, VCC - V

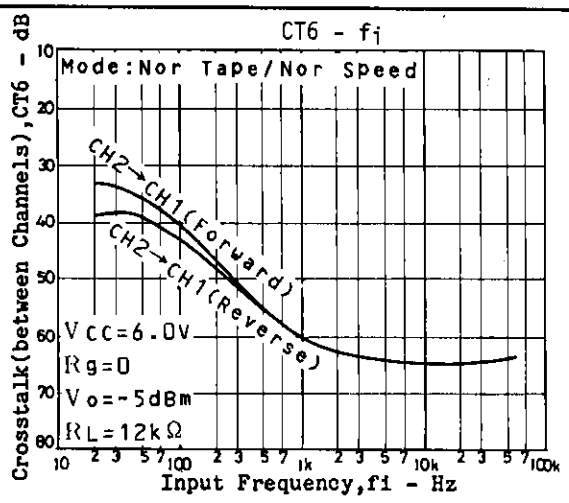

CT2 - VCC
Vo=-5dBm
Rg=2.2kΩ
RL=12kΩ
fi=1kHz
Reverse→Forward
Forward→Reverse
Crosstalk (between Forward and Reverse), CT2 - dB
Supply Voltage, VCC - V


CT3 - fi
Mode: Nor Tape/Nor Speed
VCC=6.0V
Rg=2.2kΩ
Vo=-5dBm
RL=12kΩ
CH1→CH2 (Forward)
CH1→CH2 (Reverse)
Crosstalk (between Channels), CT3 - dB
Input Frequency, fi - Hz

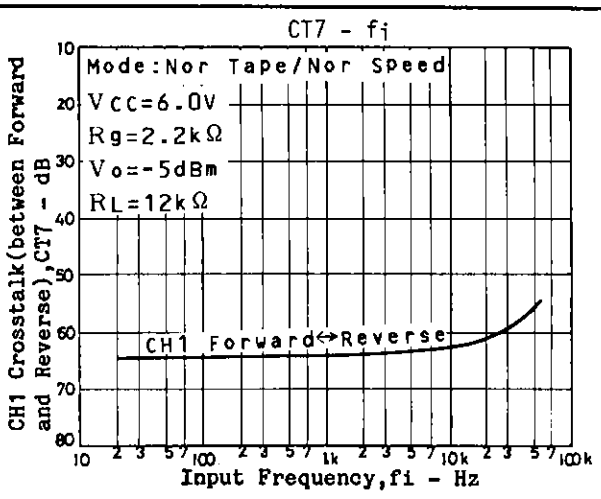

CT4 - fi
Mode: Nor Tape/Nor Speed
Forward
CH1→CH2
(Reverse)
VCC=6.0V
Rg=0
Vo=-5dBm
RL=12kΩ
CH1→CH2 (Forward)
Crosstalk (between Channels), CT4 - dB
Input Frequency, fi - Hz


CT5 - fi
Mode: Nor Tape/Nor Speed
Forward or Reverse
CH2→CH1 (Reverse)
CH2→CH1 (Forward)
VCC=6.0V
Rg=2.2kΩ
Vo=-5dBm
Crosstalk (between Channels), CT5 - dB
Input Frequency, fi - Hz

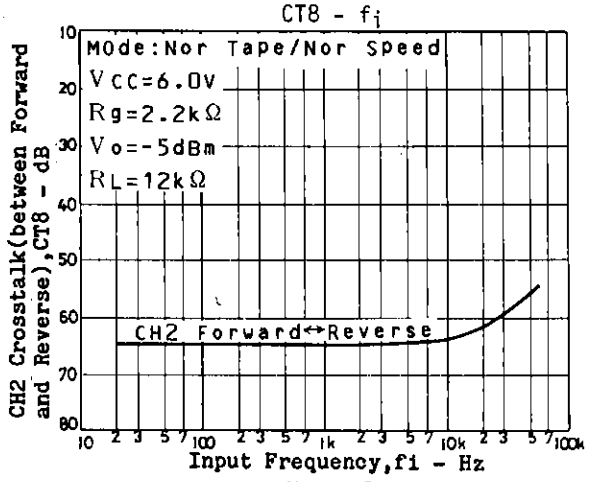
CT6 - fi



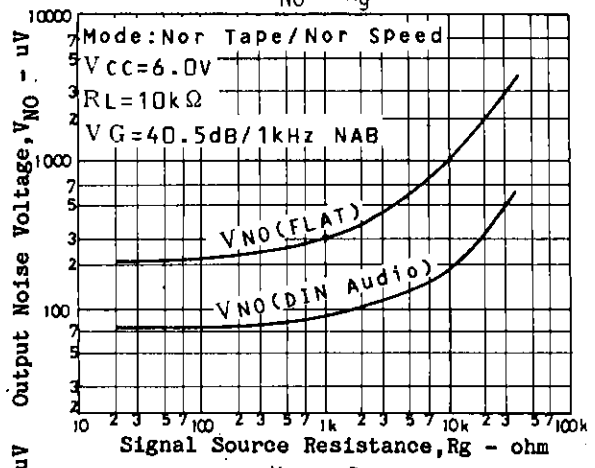
CT7 - fi



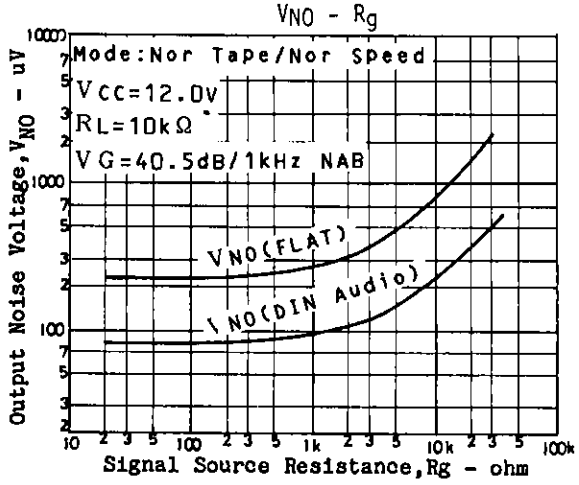
CT8 - fi



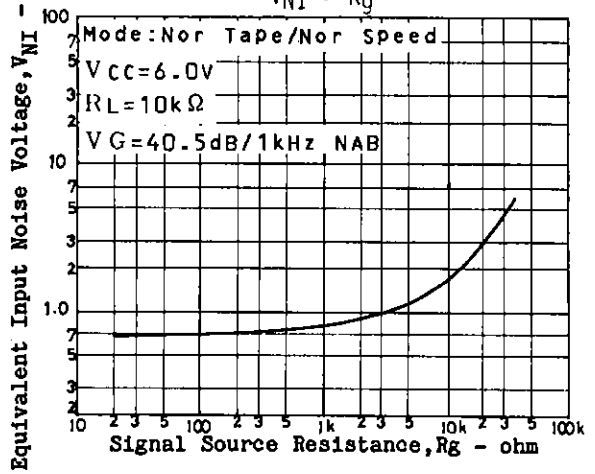
V_{NO} - Rg



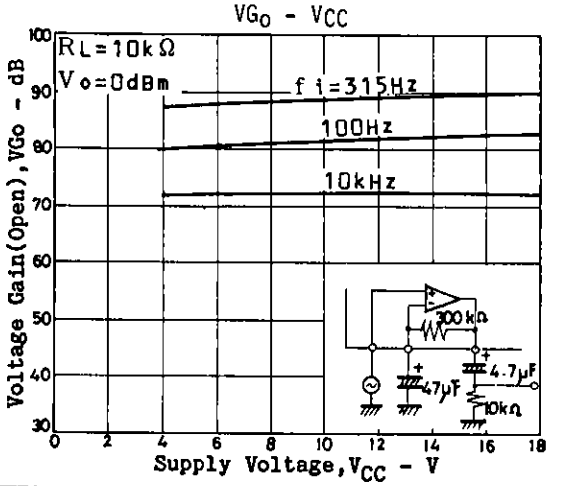
V_{NO} - Rg



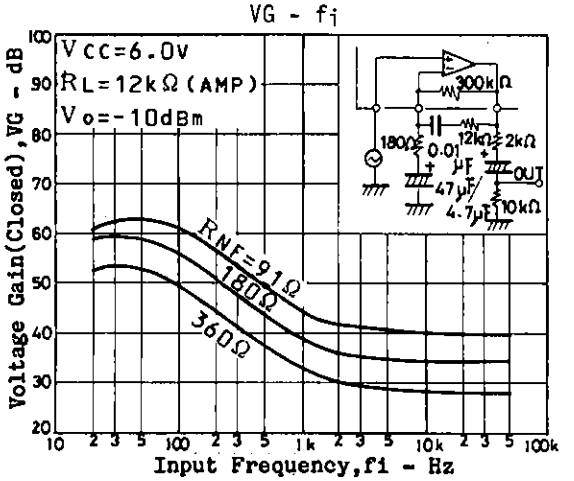
V_{NI} - Rg



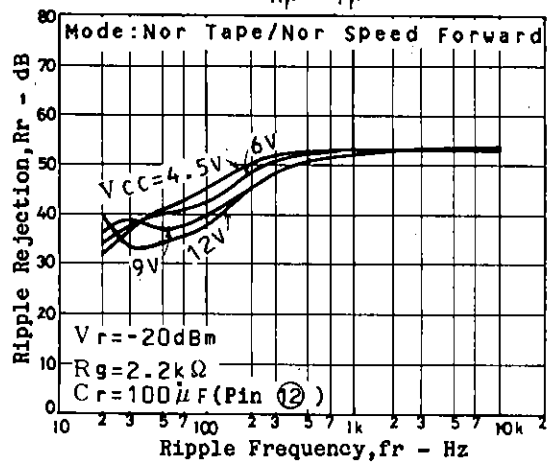
VG_O - V_{CC}



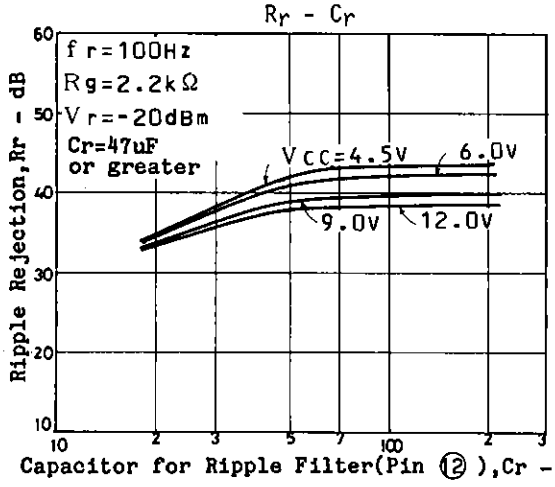
VG - fi



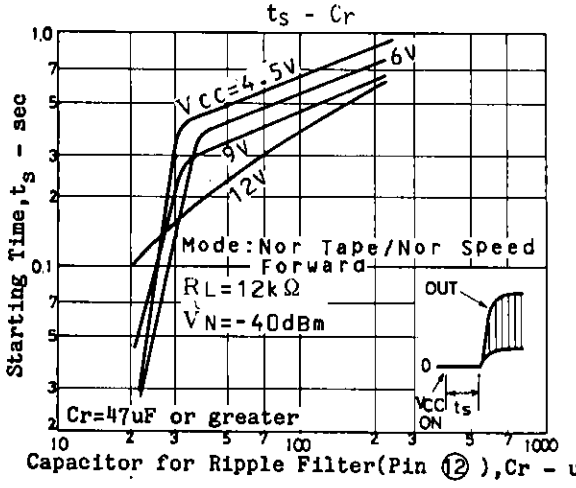
R_r - f_r



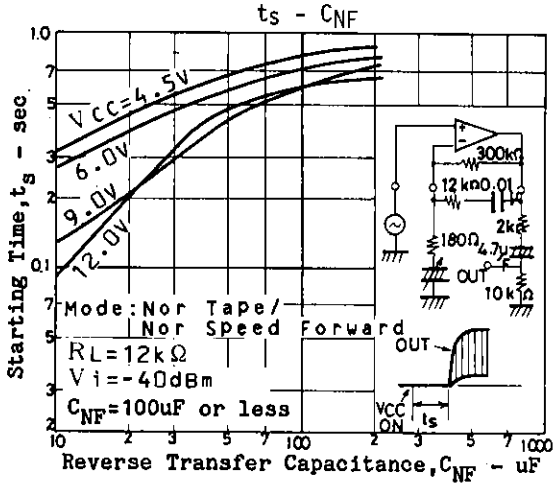
R_r - C_r



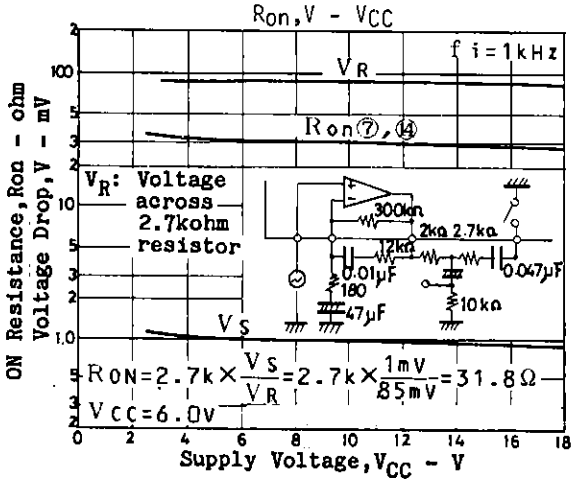
t_S - C_r



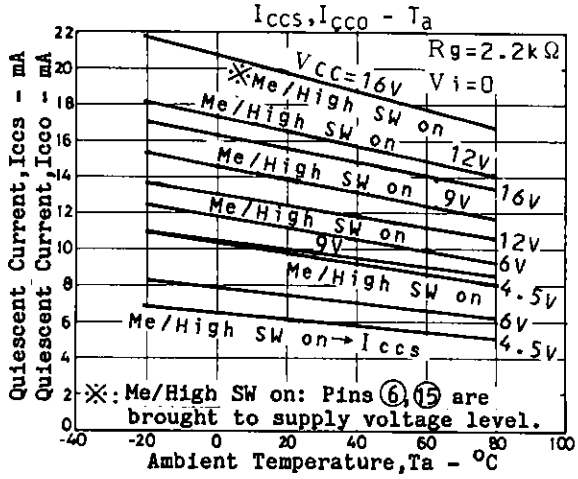
t_S - C_{NF}



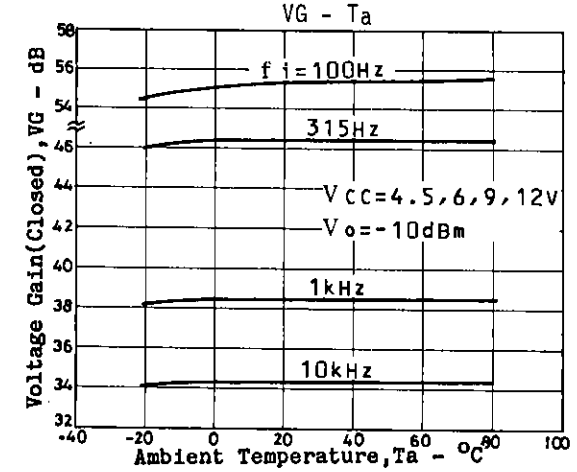
R_{on},V - V_{CC}



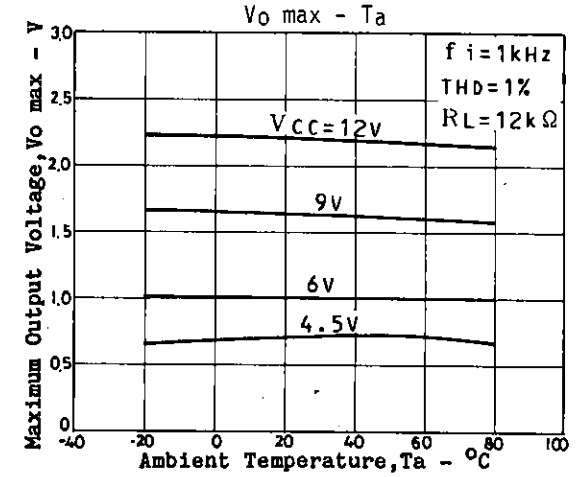
I_{CCS},I_{CCO} - T_a

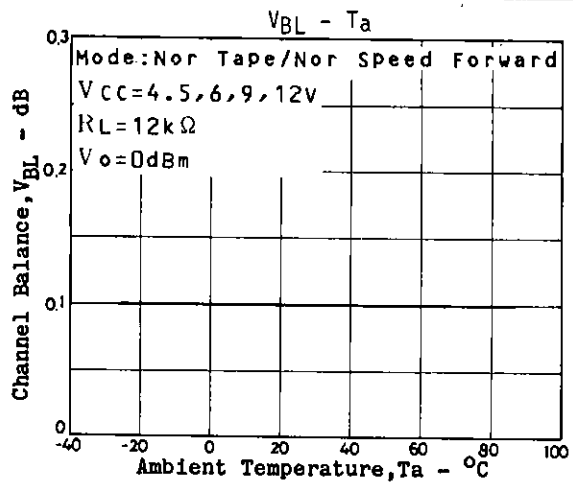


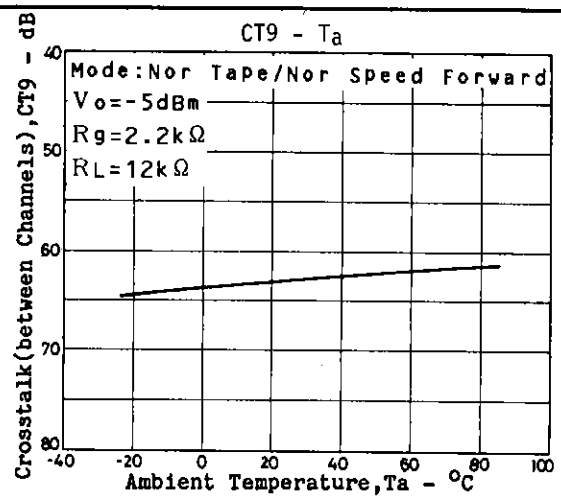
VG - T_a

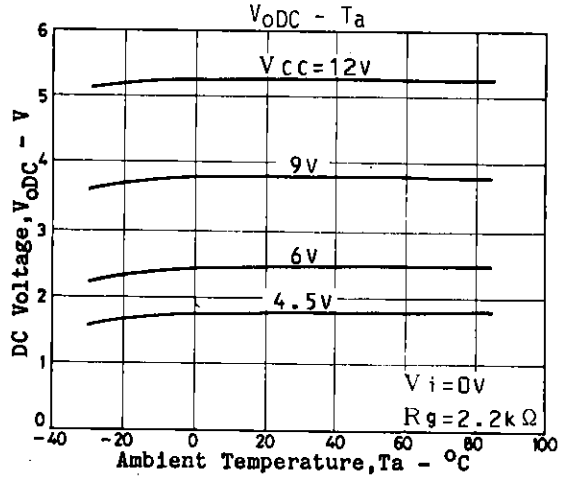


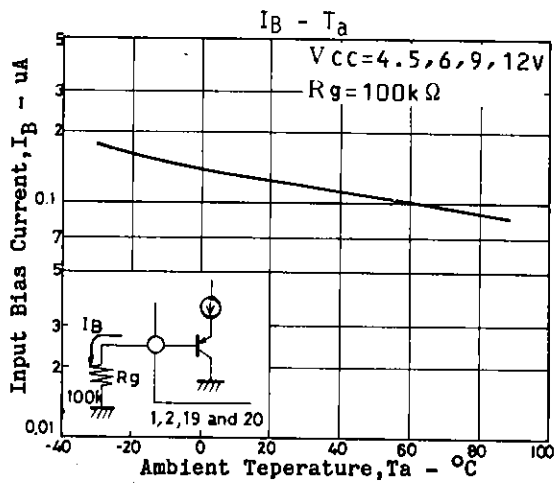
V_O max - T_a











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